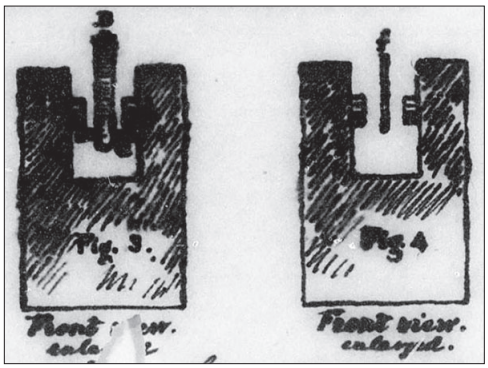
Scientific Data: Observing, Recording, and Communicating Information

For centuries, scientists have used words, numbers, and drawings in many different ways to record and communicate their efforts to make sense of the natural world.



Letterbook---2 June 1854-8 October 1855
http://www.loc.gov/mmorse000073/

Historical Background

Reports, maps, notes, letters, diagrams, sketches, and more: The artifacts in this set represent a broad sample of communication styles, formats, and methods in science, and were created by scientists across many historical eras in a wide range of disciplines. They provide rich opportunities to showcase those thinkers' efforts to document their investigations, and also offer glimpses into the nature of science.

Purpose, Audience, and Subject

Scientists create texts for different purposes and audiences. Sometimes scientists record their methods and the results of scientific investigations to inform their own future investigations. At other times, scientists write for their peers and contribute to discourse in a scientific community. Scientists can also communicate with a wider audience to inform or persuade. For example, many of Alexander Graham Bell's letters and notes about his investigations with sound and electricity were intended only for his wife; in contrast, the paintings of naturalist John James Audubon were intended for a wider audience and were part of an attempt to document all of the birds in the Americas.

Scientific texts like Bell's notes and Audubon's paintings can include distinctive features that offer clues to their purpose and audience, as well as to what is being studied. Sometimes scientists might use a combination of words and diagrams. In other cases, they might use keys, symbols, color coding, and tables to help organize and present data and observations. Scientists might use quantitative data to show observations about weather gleaned over time, the relationships between bodies in the solar system, or the workings of a battery.

The Nature of Science

Texts created by scientists can also reveal some of the characteristics of noticing, wondering, systematic study, and communicating that define science. In some cases, the texts are attempts to offer an explanatory model or to describe a cause and

effect relationship among observed characteristics and phenomena. At the same time, each text is also part of an ongoing conversation across time in which new knowledge and ideas augment or replace prior understandings and thinking.

Scientists' efforts to record and share observations and data also illustrate similarities and differences in what scientists study and how they communicate about it within scientific disciplines. In biology, scientists might study life at the cellular, organism, or ecosystem level. In each instance, living things are the focus of observation and investigation. Examining texts about cells, mammals, or forests, especially in comparison with others, can reveal both common threads and points of divergence. Scientists interested in understanding Earth's systems may use maps to organize their observations about wind patterns, rock layers, or earthquakes. However, the features of these maps can differ quite a bit depending on what is being represented. Scientists studying how light behaves might observe rainbows, reflections, or eclipses. Comparing these texts provides a complex picture of light, its properties, and its role in our world.

Resizing and Modeling to Fit a Human Scale

Objects and phenomena under scientific study span extreme scales, in terms of both size and time. Chemists might observe reactions that happen in milliseconds, while geologists study events that play out over millions of years. Scientists, however, must share observations and data on a human scale. For example, scientists studying objects at atomic or microscopic levels must create models much larger than the actual objects. Scientists describing the solar system must shrink planets and the sun so that they can be held in the hand. By examining texts created by scientists, students can see the benefits and limitations of models in representing the relative size and speed of objects and phenomena.

Suggestions for Teachers

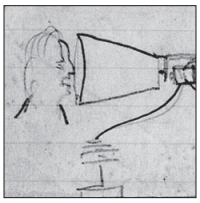
Use the items in this primary source set to explore the idea of science as a number of approaches to knowing and thinking. First, work as a class to list different types of sciences. Provide students with a set of items and ask them to sort them by discipline. What differences do they notice about the phenomena studied by scientists in different disciplines? What similarities do they see? If time allows, ask students to think of other ways to sort the items, such as the methods they see scientists using.

Use items from the set to help students strengthen their own scientific communication practices. Invite them to choose one primary source and identify how the creator organized and communicated information. How did the writer's choice of text, graphs, or images to convey information affect how easy it was to understand that information? Challenge students to think about the intended audience for the information and the choices the creator made to communicate with that audience. Group students and allow time for them to report their findings, compare texts and make a list of features that the texts have in common and a list of differences. Then ask them to revise one source for a different audience.

Introduce students to complex texts that express quantitative or technical information in both words and diagrams. Students might analyze texts that have maps or those that use tables to organize data. What choices did the scientist make when creating the text? In what ways are these attempts to communicate similar? And what is different about them? What other choices might a scientist have made? How might modern computing provide other possibilities for collecting and communicating data and observations?

Prompt students to think about scale. Ask them to sort all or a selection of the items by the size of the object or phenomenon under study. For one or more items, ask them to think about: How might these models differ from the actual objects or phenomena? What challenges did the scientist face in communicating observations and discoveries? Students might also repeat the sort by time scale, considering the relative speed of the object or phenomenon under study.

Additional Resources



Alexander Graham Bell Family Papers at the Library of Congress

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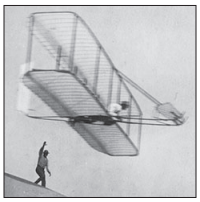

Wilbur and Orville Wright Papers at the Library of Congress

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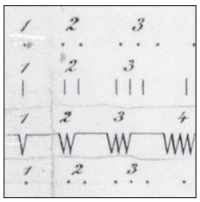

Samuel F. B. Morse Papers at the Library of Congress, 1793 to 1919

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Eadweard Muybridge gallery of images

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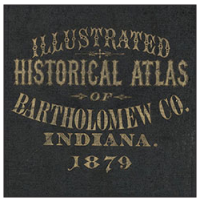
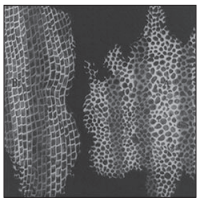


Gallery of statistical maps

https://www.loc.gov/maps/?q=statistics&fa=online-format%3Aimage&st=gallery

Primary Sources with Citations



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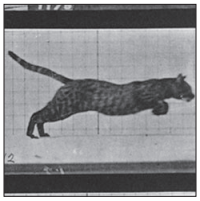

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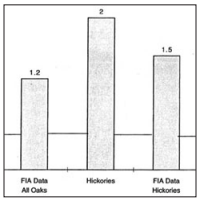

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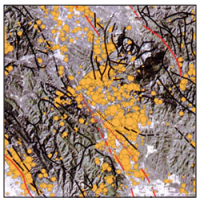

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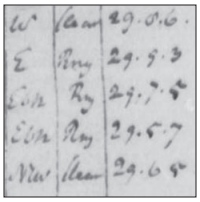

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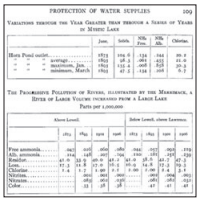

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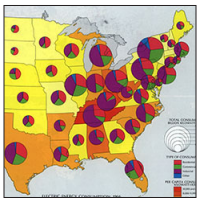

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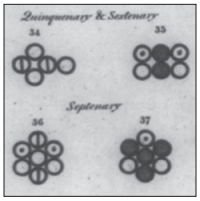

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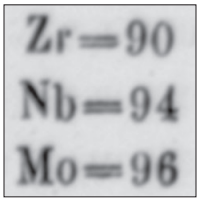

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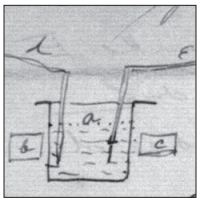

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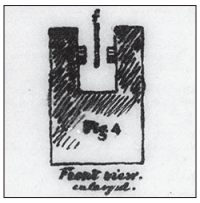

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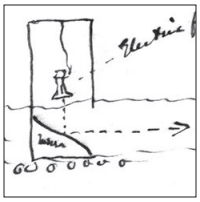

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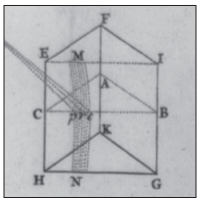

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